

IN THE CLAIMS

Please amend the presently pending claims as follows:

1. (Currently Amended) ~~Method~~A method for the decoding of a received signal comprising symbols distributed in space, time and/or frequency by ~~means of a space-time or space-frequency encoding matrix, characterized in that~~wherein the method implements a space-time decoding step and at least one iteration, each iteration comprising the following sub-steps:

- [[-]] diversity pre-decoding, which is the inverse of a diversity pre-encoding carried out when said signal is emitted, delivering pre-decoded data;
- [[-]] estimation of the symbols forming said signal, from said pre-decoded data, delivering estimated symbols;
and
- [[-]] diversity pre-encoding identical to said diversity pre-encoding implemented at emission, applied to said estimated symbols, to give an estimated signal, except for the last iteration.

2. (Currently Amended) ~~Decoding~~The method according to claim 1, ~~characterized in that it comprises the following steps comprising:~~

- [[-]] the space-time decoding, which is the inverse of the space-time encoding implemented at emission, delivering a decoded signal;
- [[-]] equalization of said decoded signal, delivering an equalized signal;
- [[-]] conversion of ~~the~~a matrix of the equalized signals into a diagonal matrix, obtained from a total encoding/channel/decoding matrix taking account of at least said encoding matrix, and of a decoding matrix, ~~corresponding to the matrix~~ that is the conjugate transpose of said encoding matrix;
- [[-]] the diversity pre-decoding, which is the inverse of a

- the diversity pre-encoding implemented at emission of said signal, delivering the pre-decoded data;
- [[-]] the estimation of the symbols forming said signal, from said pre-decoded data, delivering the estimated symbols;
- [[-]] the diversity pre-encoding, identical to said diversity pre-encoding implemented at emission, applied to said estimated symbols, to give ~~an~~the estimated signal; and
- [[-]] at least one iteration of an interference cancellation step implementing the following sub-steps:
- [[-]] subtraction, from said equalized signal, of said estimated signal multiplied by an interference matrix, delivering an optimized signal ;
- [[-]] diversity pre-decoding of said optimized signal, that is the inverse of ~~a~~the diversity pre-encoding implemented at emission of said signal, delivering improved pre-decoded data;
- [[-]] estimation of the symbols forming said optimized signal, from the improved pre-decoded data, delivering new estimated symbols; and
- [[-]] diversity pre-encoding identical to said diversity pre-encoding implemented at emission, applied to said new estimated symbols to give a new estimated signal, except for the last iteration.

3. (Currently Amended) ~~A~~The method according to claim 2, ~~characterised in that~~wherein said space-time decoding and equalization steps and/or said equalization and conversion steps are done jointly.

4. (Currently Amended) ~~A decoding~~The method according to ~~any of the claims 1 to 3, characterized in that~~ claim 1, wherein said encoded symbols ~~being~~are emitted by means of at least two antennas, which produce ~~the~~ different corresponding transmission

channels and wherein the method of decoding are taken takes the different corresponding transmission channels comprehensively into account.

5. (Currently Amended) ~~Decoding~~The method according to ~~any of the claims 2 to 4, characterized in that~~claim 2, wherein said equalization step implements an equalization according to one of the techniques belonging to the group comprising:

- MMSE type equalization;
- EGC type equalization;
- ZF type equalization; and
- equalization taking account of a piece of information representing ~~the~~ a signal-to-noise ratio between the received signal and ~~the~~ a reception noise.

6. (Currently Amended) ~~Decoding~~The method according to ~~any of the claims 2 to 5, characterized in that~~ claim 2, wherein said steps of symbol estimation implement a soft decision, associating a piece of confidence information with ~~a~~the soft decision and ~~in that~~ said subtraction step or steps take account of said pieces of confidence information.

7. (Currently Amended) ~~Decoding~~The method according to ~~any of the claims 2 to 5, characterized in that~~claim 2, wherein said received signal ~~is~~comprises a multicarrier signal.

8. (Currently Amended) ~~A decoding~~The method according to ~~any of the claims 1 to 7, characterized in that~~ claim 1, wherein said pre-encoding is obtained by one of the following methods:

- ~~[[-]]~~ a spread-spectrum techniques technique; and
- ~~[[-]]~~ linear pre-encoding.

9. (Currently Amended) ~~A decoding~~The method according to ~~any of the claims 1 to 8, characterized in that it~~ claim 1, wherein the method implements an automatic gain control step before or after said equalization step and/or during at least one of said

iterations.

10. (Currently Amended) ~~A decoding~~The method according to ~~any of the claims 1 to 9, characterized in that it comprises~~ claim 1 and further comprising a channel-decoding step, symmetrical with a channel-encoding step implemented at emission.

11. (Currently Amended) ~~A decoding~~The method according to claim 10, ~~characterized in that~~ wherein said channel-decoding step implements a turbo-decoding operation.

12. (Currently Amended) ~~A decoding~~The method according to ~~any of the claims 1 to 11, characterized in that it comprises~~ claim 1 and further comprising at least one de-interlacing step and at least one re-interlacing step, corresponding to an interlacing implemented at emission.

13. (Currently Amended) ~~A decoding~~The method according to ~~any of the claims 1 to 12, characterized in that it comprises~~ claim 1 and further comprising a step of improvement of a channel estimation, taking account of the ~~data estimated~~ estimated symbols during at least one of said iterations.

14. (Currently Amended) ~~A decoding~~The method according to ~~any of the claims 1 to 9, characterized in that, said received signal being transmitted~~ claim 2 and further comprising transmitting by means of four antennas the signal to be received, referred to as the received signal, through at least one transmission channel, wherein said total encoding/channel/decoding matrix is equal to:

$$G = \gamma \begin{bmatrix} A & 0 & 0 & J \\ 0 & A & -J & 0 \\ 0 & -J & A & 0 \\ J & 0 & 0 & A \end{bmatrix}$$

with :

$$A = |h_1|^2 + |h_2|^2 + |h_3|^2 + |h_4|^2$$

$J = 2\text{Re}\{h_1 h_4^* - h_2 h_3^*\}$, representing the interference, and

$$\gamma = \frac{1}{|h_1|^2 + |h_2|^2 + |h_3|^2 + |h_4|^2 + \frac{1}{\text{SNR}}}$$

where: $H = \begin{bmatrix} h_1 & h_2 & h_3 & h_4 \\ -h_2^* & h_1^* & -h_4^* & h_3^* \\ -h_3^* & -h_4^* & h_1^* & h_2^* \\ h_4 & -h_3 & -h_2 & h_1 \end{bmatrix}$ is a matrix grouping the space-

time encoding and the transmission channel,
and SNR represents the signal-to-noise ratio.

15. (Currently Amended) ~~A decoding~~The method according to any of
~~the claims 1 to 14, characterized in that, said received signal~~
~~being transmitted~~claim 2 and further comprising transmitting by
~~means of eight antennas the signal to be received, referred to as~~
~~the received signal, through at least one transmission channel ,~~
wherein said total encoding/channel/decoding matrix is equal to:

$$G = \gamma \cdot H^H \cdot H = \gamma \begin{bmatrix} A & 0 & 0 & 0 & J & 0 & 0 & 0 \\ 0 & A & 0 & 0 & 0 & J & 0 & 0 \\ 0 & 0 & A & 0 & 0 & 0 & J & 0 \\ 0 & 0 & 0 & A & 0 & 0 & 0 & J \\ J & 0 & 0 & 0 & A & 0 & 0 & 0 \\ 0 & J & 0 & 0 & 0 & A & 0 & 0 \\ 0 & 0 & J & 0 & 0 & 0 & A & 0 \\ 0 & 0 & 0 & J & 0 & 0 & 0 & A \end{bmatrix}$$

with $A = |h_1|^2 + |h_2|^2 + |h_3|^2 + |h_4|^2 + |h_5|^2 + |h_6|^2 + |h_7|^2 + |h_8|^2$ and

$$J = 2\text{Im}\{h_1 h_5^* + h_2 h_6^* + h_3 h_7^* + h_4 h_8^*\}$$

and $\gamma = \frac{1}{|h_1|^2 + |h_2|^2 + |h_3|^2 + |h_4|^2 + |h_5|^2 + |h_6|^2 + |h_7|^2 + |h_8|^2 + \frac{1}{\text{SNR}}}$

$$\text{where : } H = \begin{bmatrix} h_1 & h_2 & h_3 & h_4 & h_5 & h_6 & h_7 & h_8 \\ h_2 & -h_1 & h_4 & -h_3 & h_6 & -h_5 & h_8 & -h_7 \\ h_3 & -h_4 & -h_1 & h_2 & h_7 & -h_8 & -h_5 & h_6 \\ h_4 & h_3 & -h_2 & -h_1 & h_8 & h_7 & -h_6 & -h_5 \\ h_1^* & h_2^* & h_3^* & h_4^* & h_5^* & h_6^* & h_7^* & h_8^* \\ h_2^* & -h_1^* & h_4^* & -h_3^* & h_6^* & -h_5^* & h_8^* & -h_7^* \\ h_3^* & -h_4^* & -h_1^* & h_2^* & h_7^* & -h_8^* & -h_5^* & h_6^* \\ h_4^* & h_3^* & -h_2^* & -h_1^* & h_8^* & h_7^* & -h_6^* & -h_5^* \\ h_5 & h_6 & h_7 & h_8 & h_1 & h_2 & h_3 & h_4 \\ h_6 & -h_5 & h_8 & -h_7 & h_2 & -h_1 & h_4 & -h_3 \\ h_7 & -h_8 & -h_5 & h_6 & h_3 & -h_4 & -h_1 & h_2 \\ h_8 & h_7 & -h_6 & -h_5 & h_4 & h_3 & -h_2 & -h_1 \\ h_5^* & h_6^* & h_7^* & h_8^* & h_1^* & h_2^* & h_3^* & h_4^* \\ h_6^* & -h_5^* & h_8^* & -h_7^* & h_2^* & -h_1^* & h_4^* & -h_3^* \\ h_7^* & -h_8^* & -h_5^* & h_6^* & h_3^* & -h_4^* & -h_1^* & h_2^* \\ h_8^* & h_7^* & -h_6^* & -h_5^* & h_4^* & h_3^* & -h_2^* & -h_1^* \end{bmatrix}$$

is a matrix grouping the space-time encoding and the transmission channel and SNR represents the signal-to-noise ratio.

16. (Currently Amended) The method of claim 14 and further comprising, prior to the step of transmitting, Encoding and decoding method, characterized in that encoding said signal to be received, wherein the encoding implements a space-time encoding such that:

$$H = \begin{bmatrix} h_1 & h_2 & h_3 & h_4 & h_5 & h_6 & h_7 & h_8 \\ h_2 & -h_1 & h_4 & -h_3 & h_6 & -h_5 & h_8 & -h_7 \\ h_3 & -h_4 & -h_1 & h_2 & h_7 & -h_8 & -h_5 & h_6 \\ h_4 & h_3 & -h_2 & -h_1 & h_8 & h_7 & -h_6 & -h_5 \\ h_1^* & h_2^* & h_3^* & h_4^* & h_5^* & h_6^* & h_7^* & h_8^* \\ h_2^* & -h_1^* & h_4^* & -h_3^* & h_6^* & -h_5^* & h_8^* & -h_7^* \\ h_3^* & -h_4^* & -h_1^* & h_2^* & h_7^* & -h_8^* & -h_5^* & h_6^* \\ h_4^* & h_3^* & -h_2^* & -h_1^* & h_8^* & h_7^* & -h_6^* & -h_5^* \\ h_5 & h_6 & h_7 & h_8 & h_1 & h_2 & h_3 & h_4 \\ h_6 & -h_5 & h_8 & -h_7 & h_2 & -h_1 & h_4 & -h_3 \\ h_7 & -h_8 & -h_5 & h_6 & h_3 & -h_4 & -h_1 & h_2 \\ h_8 & h_7 & -h_6 & -h_5 & h_4 & h_3 & -h_2 & -h_1 \\ h_5^* & h_6^* & h_7^* & h_8^* & h_1^* & h_2^* & h_3^* & h_4^* \\ h_6^* & -h_5^* & h_8^* & -h_7^* & h_2^* & -h_1^* & h_4^* & -h_3^* \\ h_7^* & -h_8^* & -h_5^* & h_6^* & h_3^* & -h_4^* & -h_1^* & h_2^* \\ h_8^* & h_7^* & -h_6^* & -h_5^* & h_4^* & h_3^* & -h_2^* & -h_1^* \end{bmatrix}$$

~~and in that the decoding is a decoding according to claim 14.~~

17. (Currently Amended) ~~Receiver implementing means for decoding~~
A receiver for receiving a received signal, comprising symbols distributed in space and time and/or frequency by means of a space-time encoding matrix, ~~characterized in that it comprises~~
wherein the receiver comprises means of space-time decoding that is the inverse of the space-time encoding implemented at emission, and:

[[~~-~~]] means of diversity pre-decoding ~~of said optimized signal~~, performing a pre-decoding which is the inverse of a diversity pre-encoding carried out at emission of said signal, delivering pre-decoded data;

[[~~-~~]] means of estimation of the symbols forming said ~~optimized~~ signal, from the pre-decoded data, delivering new estimated symbols;

[[~~-~~]] means of diversity pre-encoding, performing a pre-encoding identical to said diversity pre-encoding implemented at emission, applied to said new estimated symbols, to give a new estimated signal,

said means of diversity pre-decoding, estimation, and diversity pre-encoding being implemented at least once for each symbol.

18. (Currently Amended) ~~Method~~ A method for the decoding of a received signal comprising symbols distributed in space, time and/or frequency by means of a space-time or space-frequency encoding matrix, ~~characterized in that~~ wherein the method comprises ~~the following steps:~~

- diagonalization, obtained from a total encoding/channel/decoding matrix taking account of at least said encoding matrix, of a decoding matrix, corresponding to the matrix that is the conjugate transpose of said encoding matrix;
- demodulation, symmetrical with a modulation implemented at emission;
- de-interlacing symmetrical with an interlacing implemented at emission;
- channel decoding symmetrical with a channel encoding implemented at emission;
- re-interlacing, identical with the ~~one~~ interlacing implemented at emission;
- re-modulation identical with the ~~one~~ modulation implemented at emission, delivering an estimated signal; and
- at least one iteration of an interference cancellation step comprising a subtraction from an equalized signal of said estimated signal multiplied by an interference matrix, delivering an optimized signal.